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10/822,691	04/13/2004	Takashi Noguchi	OKI 419	5003

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EXAMINER	
NGUYEN, JOSEPH H	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Office Action Summary	Application No.	Applicant(s)	
	10/822,691	NOGUCHI, TAKASHI	
	Examiner	Art Unit	
	Joseph Nguyen	2815	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *02 November 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19,34 and 37-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19 and 37-40* is/are rejected.

7)☒ Claim(s) *10,15 and 41-44* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 April 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 6-9, 14, 17 and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Smith (US Patent No. 6,114,763)

Regarding claim 1, Smith discloses in figure 2A a heat radiation structure of a semiconductor device (1) comprising a substrate (7) having on a surface thereof a first area (the central portion) on which the semiconductor device (1) is mounted, and a second area which surrounds the first area; and the semiconductor device having a first surface and a second surface opposite to the first surface, the second surface having a periphery, the semiconductor device additionally having a plurality of terminals (3) provided on the first surface, wherein the semiconductor device is mounted on the substrate in such a manner that the first surface is opposite to the surface of the substrate, wherein a first heating radiating film (elements 12 on the left and right hand side, not the central portion) is disposed on the second area of the substrate, and a second heat radiating film (element 12 in the central portion) is disposed on the second surface of the semiconductor device but does not extend beyond the periphery of the second surface with the second heat radiating film being apart from the first heat

radiating film, and wherein the second heating radiating film has a periphery and a rear side that are exposed to air. See column 6, lines 1-26.

It is noted that element 7 is a support element on which the chip 1 is mounted such that element 7 can function as "substrate". Also, element 12 is a heat spreader, which inherently conducts and radiates heat and thus can function as "heat radiating film" herein.

Regarding claim 2, Smith discloses in figure 2A a heat radiation structure of a semiconductor device (1) comprising a substrate (7) with the semiconductor device (1) mounted on the surface thereof; and the semiconductor device which includes a first surface, a second surface opposite to the first surface and having a periphery and a plurality of side surfaces provided between the first surface and the second surface, the semiconductor device being provided with a plurality of terminals (3) on the first surface, wherein the semiconductor device is mounted on the substrate in such a manner that the first surface is opposite to the surface of the substrate, wherein a heat radiating film (element 12 in the central portion) is disposed on the second surface of the semiconductor device without extending beyond the periphery of the second surface and exposes the side surface of the semiconductor device; and wherein the heat radiating film (12) has a peripheral edge and a rear side that are exposed to air.

Regarding claim 6, Smith discloses in figure 2A wirings (6) are formed on the surface of the substrate (7) and the terminals (3) of the semiconductor device (1) and the wirings (6) of the substrate are electrically connected to one another.

Regarding claim 7, Smith discloses element (1) is the chip which includes a semiconductor element formed with an electronic circuit (column 1, lines 19-25) and a resin layer (element 4 in figure 2A. Also see column 4, lines 56-58) formed on the semiconductor element and the terminals (3) are formed on the resin layer (4).

Regarding claim 8, Smith discloses in figure 2A the surfaces of the first and second radiating films (12) are exposed.

Regarding claim 9, Smith discloses in figure 2A wirings (6) are formed on the surface of the substrate and the first heat radiating film (12) is formed above so as to cover the wirings therein.

Regarding claim 14, Smith discloses the first and second heat radiating films (12) respectively comprise a common material.

Regarding claim 17, Smith discloses elements (12) are heat spreaders that inherently comprise a thermal emission film having thermal radiation so as to dissipate heat away from the semiconductor device.

Regarding claim 37, Smith discloses in figure 2A a heat radiation structure in combination with a semiconductor device (1) with a wafer level chip size package, the semiconductor device having a first surface with terminals (3) and having a second surface with a periphery, the second surface of the semiconductor device being oriented opposite the first surface, said heat radiation structure comprising a substrate (7) having on a surface thereof a first area (the central portion) and a second area adjacent the first area, the semiconductor device being mounted on the first area of the substrate with the first surface of the semiconductor device facing the substrate, the

semiconductor device covering the first area; a first heat radiating film (12) on the substrate in the second area; and a second heat radiating film (element 12 in the central portion) disposed on the second surface of the semiconductor device without extending beyond the periphery of the second surface and without overlapping the first heat radiating film, the second heat radiating film having a peripheral edge and a rear side are exposed to air.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 3 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith in view of Agraharam et al. (US Publication No. 2004/0188813).

Regarding claims 3 and 5, Smith discloses in figure 2A the substrate (7) is provided with external electrodes (10). Smith does not disclose the external electrodes are connected to an external board. However, Agraharam et al. discloses in figure 2 the substrate (210) is provided with external electrodes (230) connected to an external board (220) to form an electronic assembly to be used in an electronic system (paragraph [0002]). In view of such teaching, it would have been obvious at the time of the present invention to modify Smith by including the substrate having the external

electrodes connected to an external board to form an electronic assembly to be used in an electronic system.

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smith in view of Agraharam et al. and further in view of Urushima (US Patent No. 6,791,195).

Regarding claim 4, Smith discloses in figure 2A the substrate (7) is provided with external electrodes (10). Smith does not disclose the external electrodes are connected to an external board. However, Agraharam et al. discloses in figure 2 the substrate (210) is provided with external electrodes (230) connected to an external board (220) to form an electronic assembly to be used in an electronic system (paragraph [0002]). In view of such teaching, it would have been obvious at the time of the present invention to modify Smith by including the substrate having the external electrodes connected to an external board to form an electronic assembly to be used in an electronic system.

Further, Smith and Agraharam et al. do not disclose the semiconductor device is mounted on the substrate in plural form. However, Urushima discloses in figure 6 the semiconductor device (3) is mounted on the substrate (14) in plural form to obtain a multi chip module with a high level of heat radiation (column 18, lines 14-20). In view of such teaching, it would have been obvious at the time of the present invention to modify Smith and Agraharam et al. by including the semiconductor device mounted on the substrate in a plural form to obtain a multi chip module with a high level of heat radiation.

Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith in view of Chu et al. (US Patent No. 5,168,348).

Regarding claim 11, Smith discloses in figure 2A the second heat raiding film (12) formed on the second surface of the semiconductor device (1). Smith does not disclose openings defined in the second heat radiating film and parts of the second surface of the semiconductor device exposed through the openings. However, Chu discloses in figure 3 openings (holes between elements 114) defined in the second heat film (114) and parts of the second surface of the semiconductor device (102) exposed through the openings to enhance convective cooling performance on the semiconductor device (column 3, lines 28-30). In view of such teaching, it would have been obvious at the time of the present invention to modify Smith by including openings defined in the second heat radiating film and parts of the second surface of the semiconductor device exposed through the openings to enhance convective cooling performance on the semiconductor device.

Regarding claim 12, Smith discloses in figure 2A substantially all the structure set forth in claim 12 except a seal applied onto the second surface of the semiconductor device and openings defined in the second heat radiating film such that the seal is exposed. However, Chu discloses in figure 3 the metal sheet (12), which can function as "a seal" and opening defined in the second heat radiating film (112) such that the seal being exposed to enhance convective cooling performance on the semiconductor device (column 3, lines 28-30). It is noted that metal sheet 112 is thermal conductive and thus can function to further enhance the heat dissipation in the semiconductor

device. In view of such teaching, it would have been obvious at the time of the present invention to modify Smith by including a seal applied onto the second surface of the semiconductor device and openings defined in the second heat radiating film such that the seal being exposed to enhance convective cooling performance on the semiconductor device.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smith in view of O'Connor et al. (US Publication No. 2002/0145194)

Regarding claim 13, Smith discloses in figure 2A the first and second radiating films have a certain thickness, not necessarily the thickness of 30 μm to 200 μm as claimed. However, O' Connor et al. discloses in paragraph [0046] the heat spreading layer (100) has a thickness of 0.05 mm equivalent to 50 μm, which falls in the claimed range of 30 μm to 200 μm to optimally form a heat spreading film that accommodates the height of a typical electrical connection (paragraph [0046]). In view of such teaching, it would have been obvious at the time of the present invention to modify Smith by forming the first and second heat radiating films with a thickness range of 30 μm to 200 μm in order to accommodate the height of a typical electrical connection in a semiconductor device.

Claims 16, 18, 19, 34 and 38-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith in view of Aoki et al. (US Publication No. 2003/0037866).

Regarding claim 16, Smith discloses element 12 is the heat radiating film. Smith does not disclose a film having an insulating property is used for the first and second heat radiating films. However, Aoki et al. teaches in paragraph [0021] the heat radiating film can be formed of silicon resins, which has an insulating property in order to improve fire resistance and softness. In view of such teaching, it would have been obvious at the time of the present invention to modify Smith by using a film having an insulating property for the first and second heat radiating films in order to improve fire resistance and softness.

Regarding claims 18-19, 34 and 38-40, Smith discloses element 12 is the heat radiating film. Smith does not disclose the material for the first and second heat radiating films being silica alumina ceramics. However, Aoki et al. discloses in paragraph [0021] silica alumina ceramics being used for the heat radiating film in order to effectively provide a heat radiating film for the electronic device (paragraph [0005]). In view of such teaching, it would have been obvious at the time of the present invention to modify Smith by using silica alumina ceramics to form the first and second heat radiating films in order to effectively provide a heat radiating film for the electronic device. It is noted that silica alumina is also known as "ceramics".

Allowable Subject Matter

Claims 10, 15, 41, 42, 43 and 44 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The reference (s) of record do not teach or suggest, either singularly or in combination at least the limitation of "openings are defined in the first heat radiating film, and parts of the surface of the substrate are exposed through the openings" for claim 10; "the first heat radiating film and the second heat radiating film are different in thermal expansion coefficient" for claim 15; "the first heat radiating film is thinner than the semiconductor device, and has a rear side that is exposed to air" for claims 41 and 42; "the first and second heat radiating films are disposed at different distances from the substrate" for claims 43 and 44.

Response to Arguments

Applicant's arguments filed on 11/02/2007 have been fully considered but they are not persuasive.

With respect to claims 1, 2 and 37, applicant argues Smith's heat spreader 12 is unitary element and thus clearly extends beyond the periphery of the upper surface of Smith's chip 1. However, as explained above, the central portion of element 12 herein is considered as "a second heat radiating film disposed on the second surface of the semiconductor device 1", and this heat radiating film is clearly not extending beyond the periphery of the second surface. Further, nowhere does Smith teach the heat spreader 12 is a unitary element that would extend beyond the periphery of the second surface. Rather, this is merely a speculation without any convincing evidences. The ports 14 can be used to encapsulate the assembly but clearly the central portion of the heat spreader

12 does not extend beyond the periphery of the second surface. Therefore, Smith reads on the claimed subject matter therein.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Joseph Nguyen whose telephone number is (571) 272-1734. The examiner can normally be reached on Monday-Friday, 8:30 am- 5:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Parker can be reached on (571) 272-2298. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300 for regular communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

KENNETH PARKER
SUPERVISORY PATENT EXAMINER

Joseph Nguyen

Patent Examiner

January 14, 2008.